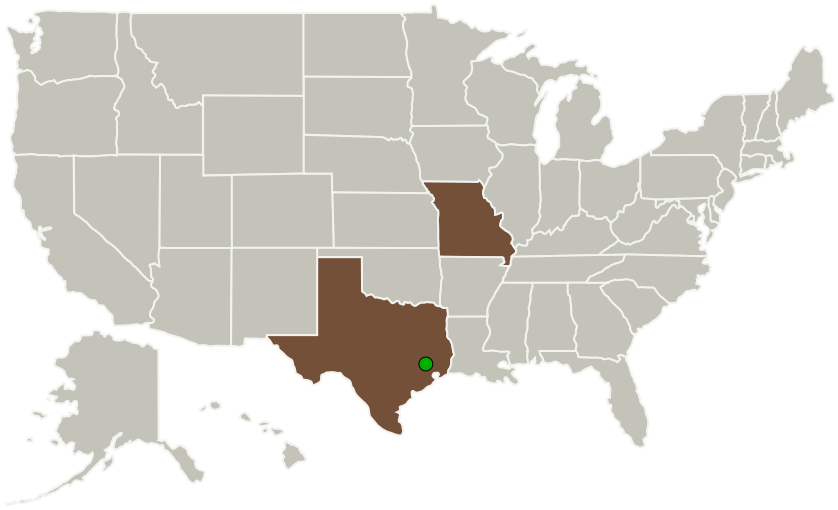
Advanced Filtering Techniques Applied to Spaceflight, Phase I

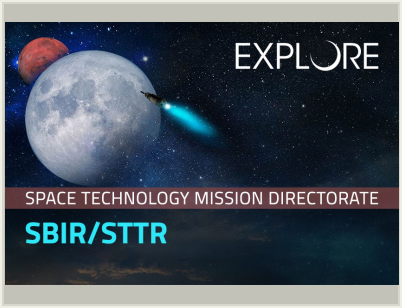
Completed Technology Project (2010 - 2010)

Project Introduction

Spacecraft need accurate position and velocity estimates in order to control their orbits. Some missions require more accurate estimates than others, but nearly all missions need some type of orbit determination. IST-Rolla seeks to provide highly accurate algorithms that do not overpower the spacecraft's computer. Many new, powerful algorithms exist such as the particle filter and the unscented Kalman filter, but most of them involve integrating several state vectors, and those integrations devour the computing power available. IST-Rolla will implement the è-D technique, the cost based filter (CBF), and the neural network estimator for orbit determination(developed by IST-Rolla Engineers) and analyze the results. These filters are nonlinear and might provide better accuracy than the extended Kalman filter (EKF) which is widely used, without being computationally cumbersome as the particle filter and unscented Kalman filter. The theta-D technique approximates the solution to the filter-related Ricatti Equation. The CBF is an attempt to formulation of the filter under an 'optimal' framework. The neural network estimator works to estimate the modeling errors online so that the estimates become more accurate.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
IST-Rolla	Lead Organization	Industry Minority-Owned Business	Rolla, Missouri
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Missouri	Texas

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139978)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

IST-Rolla

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jason Searcy

Co-Investigator:

Jason Searcy

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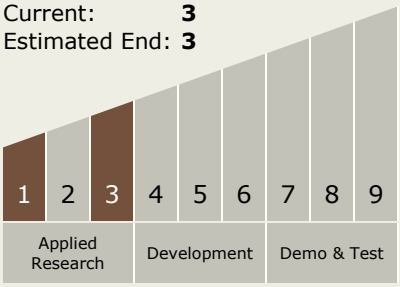
Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.3 Navigation Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System